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ABSTRACT

The reinforcing properties of language were examined with four autistic and five mentally retarded children matched for mean nonverbal mental age (32-37 months). Ss were shaped to pull a lever which produced 2 seconds of a tape recorded story. The story was read with the following conditions: little pitch variance from word to word, but with normal syllable durations (atonal); each syllable of equal duration, but normal pitch variance (arhythmic); each syllable of equal duration and little pitch variance (flat); and normal syllable duration and pitch variance (normal). Differences in the relative reward values for each of the four conditions confirmed the hypothesis that abnormalities in autistic children's speech result from sources of reinforcement arising in speech production rather than in misperception of speech attributes. (Author/CL)

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Reinforcing Effects of Speech Attributes in Autistic and Mentally Retarded Children.[1]

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Abnormalities in language is one of the key symptoms that characterize the autistic child (Ornitz & Ritvo, 1968; Rutter, 1974). Failure to acquire language, or language which is predominantly composed of echolalia or a "sing-song" quality typify a large proportion of autistic children. The language of autistic children who do acquire a substantial vocabulary and use of grammar and syntax has been reported to be deficient in psychophysical aspects (e.g., tone, duration) of speech (Baltaxe & Simmons, 1975).

The present study was designed to assess the reinforcing properties of language for autistic and mentally retarded children. Mentally retarded children were chosen to control for nonverbal learning rate, as well as for the effects of developmental delay in speech acquisition. Both types of subjects were trained individually to pull a lever which produced as its only consequence 3 seconds of a story being read by an adult with which the child was unfamiliar. The following hypotheses were being tested:

(a) Contingent segments of the story will reinforce lever-pulling in both populations. When the lever-pull produces no consequences (extinction) the response rate will decrease in all children.

(b) Reading a story with natural intonation (tone variance) and stress (duration variance) will be more reinforcing than reading the story without tone and/or pitch variance (atonal, arhythmic or flat affect). This would be directly reflected in rates of level-pulling.

(b) Reinforcing properties of the story may be different for autistic and retarded children.

Subjects. Nine children who were inpatients at the Neuropsychiatric Institute UCLA served as subjects in this experiment. Four subjects were diagnosed according to the criteria of Ornitz & Ritvo (1968)as autistic prior to being tested in the present study. The five remaining subjects failed to meet these criteria but were evidencing developmental delay. Table 1 shows the psychological and developmental statistics for each subject in each group. Following the suggestion of Rutter (1974), the groups were equated in terms of mean non-verbal mental age (autistic group mean = 37.5 months, retarded group mean = 32.4 months). Scources for mental ages were the Merril-Palmer and in the case of retarded S#5, nonverbal parts of the Gesell.

Developmental assessment of receptive and expressive language, general concepts, auditory memory, and socialization were taken from the EPEC (Flaharty, 1976) and were made by the child's teacher.

Apparatus. The experiment was conducted in a 10' X 4' sound-insulated chamber, divided into experimental and subject compartments. The subject compartment was 4'l x4'w x6'h and contained a Lindsley manipulandum requiring approximately 400g of force to activate. Approximately 3 feet above the subject's head (when seated) was a speaker enclosure. A Ventilator fan situated on the ceiling of the subject's compartment also provided further isolation from apparatus and outside noise. The other compartment of the experimental chamber contained a tape recorder and relays, etc for programming the reinforcing events.

Stimuli. Four different variations of a male voice reading "The Three Bears" were recorded on different channels of 1/4" audio tape. On the first channel the story was read with usual appropriate intonation, inflection, and pauses. (Natural). The second channel(Atonal)contained a version of the story differing from the first only in that the pitch remained the same throughout the reading. The third channel (Arhythmic) contained a version of the story read with approximately the same pitch variation as the Natural version, except that each syllable of each word was read at the same rate. The fourth channel (Flat) contained neither pitch nor tempo variation, each syllable receiving equal duration. The Atonal, Arhythmic and Flat versions of the story were matched to the Natural version in total reading time and were within 15 seconds of each other.

Procedure.Each subject was individually shaped, by the method of successive approximations to pull the lever. Shaping was discontinued after three unassisted lever-pulls were made. Contingent upon each lever-pull, the subject heard 3 seconds of the story. The tape stopped after the three seconds and was started again by the next lever-pull. Lever-pulls made while the story was being played served to postpone offset by three seconds. Each channel (condition) was presented for five 20-second intervals, and each condition was presented once on each of five sessions in counterbalanced order. An extinction session was conducted in session three. During this session, lever-pulls received no programmed consequences. The session terminated after 3 consecutive 20-second intervals of no lever-pulling or 15 minutes had elasped.

Total number of responses were recorded for each 20-second interval.

RESULTS

All subjects (except for Retarded S#2, for which data was not recorded) acquired the lever pull after a mean of 10.75 shaping trials (range:5-28). All subjects, except Retarded S#1 ceased responding during the extinction session (range: 0-11 20-second intervals). Thus for this S, there is doubt whether the story was a reinforcing event.

Lever-pulls per 20-second interval were submitted to a 2 X 4 X 4 X 5 (Group X Condition X Order X Interval) unequal-n mixed analysis of variance (Winer, 1971). Contrary to our initial hypothesis, the only significant effect was that of Interval ($F(4,28) = 17.76$, $p < .001$). Pursuing the matter further, each S was submitted to a 2 X 5 (Condition X Interval) fixed effects analysis of variance, using the Order variable as within-cell error. The results of these analyses were illuminating, and are presented in Table 2. It can be seen from the Table that 4 of the nine Ss showed significant effects of condition. These Ss favored no Group, hence the lack of overall Group main effect. Referring back to Table 1, it was found that the mean developmental age of auditory memory (measured as the traditional digit-span) was significantly higher for Ss who showed significant effects of Condition (mean = 36.0 months) than those who failed to show differences (mean = 25.3 months, $t = 3.20$, $p < .05$).

A further surprise was evident upon inspection of the means for the Conditions for the Ss showing this effect was statistically significant. Although the two Retarded Ss (#s 3 & 4) responded higher for the Natural condition, the two Autistic Ss showed no consistency.

DISCUSSION

The results of this study demonstrated that most mentally retarded and Autistic children will maintain a lever-pull for a story told by an adult with whom they are unfamiliar. It further suggests that if these children

have auditory memory capacities of less than an approximately 36 month old normal child, they will not show any reinforcement effects of pitch or duration variation. This study will be continued further, with children of higher auditory memory ability in order to substantiate the consistencies found for the mentally retarded children and will attempt to seek patterns in possible inconsistencies of autistic children in this respect.

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GROUP	SUBJ	NONVERBAL		LANGUAGE		GENERAL	AUDIT	
		MA	IQ	RECEPT	EXPRESS	CONCEPTS	MEMORY	SOCIAL
AUTISTIC	1	17	55	30	27	30	22	12
	2	41	33	28	8	18	--	6
	3	51	118	42	30	42	36	42
	4	41	46	30	30	30	36	36
RETARDED	1	41	53	48	48	60	30	42
	2	36	66	24	18	30	24	23
	3	31	60	30	18	38	36	12
	4	24	33	18	22	18	--	8
	5	30	37	36	11	32	--	23

Table 1: Psychological statistics (nonverbal mental age and intelligence), receptive and expressive language age, general concepts, auditory memory and social ages. The last five statistics were derived from Flaharty (1976).

GROUP	SUBJ	CONDITION: ARHY	ATON	NATL	FLAT	F-test CON	INT	LANGUAGE CHARACTER
AUTISTIC	1	4.85	1.90	2.65	2.30	ns	ns	echolalia
	2	1.30	0.70	2.40	2.25	ns	6.11**	mute
	3	9.95	14.00	8.40	8.40	3.43*	4.82**	natural
	4	11.95	6.40	7.50	17.15	6.03**	ns	echolalia sing-song
RETARDED	1	6.55	10.65	7.75	7.80	ns	ns	lacks stress
	2	8.75	3.85	5.15	7.65	ns	3.04*	flat affect
	3	6.05	6.05	5.90	4.70	2.79*	ns	lacks inflect.
	4	1.35	1.45	3.90	1.30	10.63**	5.75**	lacks inflect.
	5	5.75	6.20	5.70	5.70	ns	ns	natural (few words)

Table 2: Mean lever-pull rates for each subject for Arhythmic, Atonal, Natural and Flat conditions and F statistics for condition and interval main effects.

*$p<.05$, **$p<.002$